AF

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PATENT APPLICATION

ATTORNEY DOCKET NO. 200300746-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Christopher Oriakhi	Confirmation No.:	4185
Application No.:	10/603,405	Examiner:	Paul D. Marcantoni
Filing Date:	06/24/2003	Group Art Unit:	1755

Title: CALCIUM ALUMINATE CEMENT COMPOSITIONS FOR SOLID FREEFORM FABRICATION

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on June 22, 2006.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $120	☐ 2nd Month $450	☐ 3rd Month $1020	☐ 4th Month $1590

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of $ 500. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Respectfully submitted,
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPELLANT:	Oriakhi, Christopher
SERIAL NO:	10/603,405
FILED:	June 24, 2003
CONF.NO.:	4185
FOR:	CALCIUM ALUMINATE CEMENT COMPOSITIONS FOR SOLID FREEFORM FABRICATION
ART UNIT:	1755
EXAMINER:	Marcantoni, Paul D
DOCKET NO.:	200300746-1

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8

DATE OF DEPOSIT: August 22, 2006

I hereby certify that this paper or fee (along with any paper or fee referred to as being attached or enclosed) is being deposited with the United States Postal Service under 37 C.F.R. § 1.8 on the date indicated above and is addressed to: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313.

Brenda Wiseman

Brenda Wiseman

APPELLANTS' APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Mail Stop Appeal Brief – Patents

Dear Sir:

Appellants submit this appeal brief in connection with their appeal from the final rejection of the Patent Office, mailed April 26, 2006, in the above-identified application. A Notice of Appeal was filed on June 22, 2006.

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I. REAL PARTY IN INTEREST

The real party in interest of this application is Hewlett-Packard Company or Hewlett-Packard Development Company, P.O. Box 272400, Fort Collins, Colorado, 80527-2400.

II. RELATED APPEALS AND INTERFERENCES

Appellants and Appellants' legal representatives know of no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-11 and 42-52 remain pending. Claims 12-41 have been withdrawn from consideration. The claims on appeal in this application are claims 1-11 and 42-52, which constitute all of the claims presently pending in the application.

IV. STATUS OF AMENDMENTS

No amendments to pending claims 1-11 and 42-52 have been made since the office action mailed on April 26, 2006, which was the final rejection of the pending claims.

V. SUMMARY OF INVENTION (INDEPENDENT CLAIMS 1 AND 42)

1. (Previously Presented) A method for solid free-form fabrication of a three-dimensional object (page 2, line 5), comprising:

a) applying a particulate blend in a layer, said particulate blend including calcium aluminate particulates and polymeric binder particulates (page 2, lines 6-8);

b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area (page 2, lines 8-10), wherein the hydrated cement becomes crosslinked (page 5, lines 17-19; page 9, lines 18-23);

c) hardening the hydrated cement (page 2, line 10); and

d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object (page 2, lines 10-12).

42. (Previously Presented) A method for solid free-form fabrication of a three-dimensional object (page 2, line 5), comprising:

a) applying a particulate blend in a layer, said particulate blend including calcium aluminate particulates and polymeric binder particulates (page 2, lines 6-8);

b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area (page 2, lines 8-10);

c) hardening the hydrated cement (page 2, line 10), wherein the step of hardening is accelerated by including a particulate lithium ion source in the particulate blend or a solvated lithium ion source in the liquid vehicle (page 5, lines 8-11); and

d) repeating steps a) through c) such that multiple layers of the cement are formed that are

bound to one another, thereby forming the three dimensional object (page 2, lines 10-12).

In summary, the invention claimed in independent claims 1 and 42 provides for a method to fabricate a three-dimensional object. The method includes applying a layer of a particulate blend including calcium aluminate particulates and polymeric binder particulates, ink-jetting a polyol-containing liquid onto the layer which forms a hydrated cement, hardening the hydrated cement, and repeating the process as necessary to create the three-dimensional object.

VI. ISSUE PRESENTED FOR REVIEW

The issue presented for review is: whether claims 1-11 and 42-52 are unpatentable under 35 U.S.C. § 103(a) as being obvious over U.S. Pub. No. 2001/0050031 (hereinafter "Bredt") alone or in view of U.S. Patent No. 6,165,406 (hereinafter "Jang"), and U.S. Patent No. 6,238,474 (hereinafter "Unsin").

VII. ARGUMENT

A. Brief History of Prosecution

The present application was filed on June 24, 2003, as U.S. Patent Application Serial No. 10/603,405, and is entitled INK-JET INK COMPOSITION FOR SOLID FREE-FORM FABRICATION OF CERAMIC AND PLASTIC OBJECTS. The present application was filed as an original utility application.

In the first Office Action mailed August 19, 2004, claims 1-11 and 34-41 were subject to a restriction and/or election requirement. Group I included claims 1-11, drawn generally to a method of making a three-dimensional object. Group II, including claims 34-41, was drawn to a layered article. In the same Office Action, the Examiner withdrew claims 12-33 because they were allegedly improper claims as not falling under any statutory class of invention, 35 U.S.C. § 101. The Examiner further noted that claims 12-33, if proper, would most likely be included with Group II. In a reply submitted by the Appellant on September 17, 2004, Group I, being claims 1-11, was elected. Appellant respectfully disagreed that claims 12-33 were not proper subject matter, but noted that as they were likely included in Group II, and as they were not immediately elected, this was a moot point for the time being. (It is noted for the record that these claims which were allegedly considered to not fall under any statutory class of invention are a very common type of "system" claim used regularly in similar areas of art, e.g., ink-jet arts.)

In a non-final Office Action dated December 20, 2004, the Examiner rejected all pending claims. Claims 1-11 were rejected under 35 U.S.C. § 102 as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Application No. 2001/0050031 (Bredt), U.S. Patent No. 5,387,380 (Cima), U.S. Patent No. 5,204,055 (Sachs), U.S. Patent No. 4,696,851

(Pryor), U.S. Patent No. 3,179,730 (Ingrassia), or Japanese Patent Abstract JP04363808 (Ishikawa) alone or in view of U.S. Patent No. 6,165,406 (Jang) or Popoola et al. (abstract only-Journal Materials Research 1992). Additionally, claims 1-11 were rejected under 35 U.S.C. § 112, second paragraph, as failing to set forth the subject matter which was regarded as the invention.

Appellant submitted a response to the Office Action, received by the Patent Office on March 21, 2004. In the response, Appellant amended claim 1 to read "wherein the hydrated cement becomes crosslinked" with regards to element (b). Additionally, the word "predetermined" was removed from claims 1 and 2. Appellant also added new claims 42-52, the full text of which can be found in the Appendix.

With regards to Bredt, Appellant argued that the cited reference did not teach all of the elements of the present invention. Specifically, Appellant argued that Bredt did not teach the crosslinking. Appellant further argued against the obviousness rejection by stating that Bredt failed to teach or suggest a method that would use the specific blend of particulates, particularly adapted for the liquid vehicle, capable of ink-jetting, and forming a crosslinked hydrated cement.

Regarding Cima and Sachs, Appellant argued that both lack the teaching of using the specific powder claimed in the present application. Appellant further argues a lack of teaching of the use of a polyol in a liquid vehicle for ink-jetting onto the blend, which causes the formation of a crosslinked hydrated cement. Appellant argued against the obviousness rejection on the grounds that there was no motivation or suggestion to modify the references to the present invention.

The Appellant argued that Pryor failed to teach several elements of the presently claimed

invention: most specifically, a polymeric binder particulate blended with calcium aluminate, and ink-jetting. Appellant additionally argues that Pryor failed to show motivation to modify the reference to arrive at the claimed invention.

The Appellant addressed the rejections over Ingrassa by stating that the reference lacks elements of the present invention, and fails to suggest modification. The rejection over Ishikawa was handled similarly. Regarding the Jang reference, the Appellant cited the Examiner in noting that Jang lacks the teaching of each and every element. Appellant further noted a belief that Jang was sited only as a secondary reference to show use of a colorant for forming decorative objects.

Regarding the 112 rejection, the Appellant amended claims 1 and 2 as suggested by the Examiner. The Appellant further stated disagreement with the Examiner's argument.

A second Office Action was issued and made final on June 8, 2005. In that action, the Examiner dropped all rejections and references except for rejections under 35 U.S.C. § 103(a) as obvious over Bredt alone or in view of Jang or Popoola and U.S. Patent No. 6,238,474 (Unsin). The Examiner justified the inclusion of Unsin as being necessitated by the addition of the new claims. Furthermore, the Examiner argued that all elements of the Appellant's invention were present in Bredt.

Appellant submitted a response to the second Office Action along with a Request for Continued Examination (RCE), on September 6, 2005. The Appellant did not amend the claims when filing the RCE because it was the Appellants' position that the Examiner had not shown each and every element of the claimed invention, nor was there any suggestion to modify the cited reference to arrive at the claimed invention. Specifically, the Examiner had not shown the depositing of a printing aid onto filler material. Rather, Bredt taught mixing the printing aid with

the powder material in preparation of a subsequent printing step. Furthermore, Appellant argued that the Unsin reference showed that adding accelerating agents may be known in the traditional cement arts, but there was no suggestion or teaching that it was applicable to the specific art in question, nor was there any motivation to combine from the primary reference.

Because the Appellants' did not amend the claims when filing the RCE, the third Office Action that was issued was also made final (November 17, 2005). In the Office Action, the Examiner withdrew the Popoola reference, but persisted in the rejection of claims 1-11 and 42-52 under 35 U.S.C. § 103(a) as obvious over Bredt alone or in view of Jang or and Unsin. The Examiner cited Jang as teaching that it was old in the art to add a colorant to a three dimensional object. Unsin was cited as showing that it was known and old to add a lithium accelerator such as lithium carbonate for cements. Regarding Bredt, the Examiner reasoned that because the printing aid was dispersed throughout the filler, it must be uniformly mixed, and that if uniformly mixed, it was "certain that the printing aid was deposited onto the filler material" (page 3, 2nd para.). The Examiner further argued that "changes in the sequence of adding ingredients would have been obvious to one of ordinary skill in the art" (page 4, 1st full para.). The Examiner also stated that because the "calcium aluminate cement is still a hydraulic cement and it would thus be old, conventional, and traditional to use an accelerator..." (page 5, 1st full para.).

Appellant submitted a response to the third Office Action along with a second Request for Continued Examination (RCE), on February 17, 2006. This time, the Appellants amended the two independent claims to restrict the covered subject matter and specifically require "ink-jetting" of the aqueous polyol-containing liquid (see element (b) of claims 1 and 42). Regarding the Bredt rejections, the Appellant argued again that the ingredient combination in addition to the

method is being claimed, and the Examiner generally addressed only ingredient combination. Appellant further argued that Bredt doesn't teach, and even teaches away from, ink-jetting a polyol.

Regardless of the Appellants amendments when filing the RCE, the fourth Office Action that was issued on April 26, 2006 was yet again made final. In other words, three final office actions were issued consecutively, which in the practice of the undersigned, is unusual and indicated an unwillingness of the Examiner to fairly consider the Applicant's arguments, thus, bringing the Applicant to the present appeal process. Substantively, in the Office Action, the Examiner continued in the rejection of claims 1-11 and 42-52 under 35 U.S.C. § 103(a) as obvious over Bredt alone or in view of Jang or and Unsin. The Examiner once again noted that changes in the sequence of adding would have been obvious. Regarding the amendment, the Examiner argued that Bredt does, indeed, teach the use of electromechanical ink-jet printheads to deliver fluid compositions. Additionally, the Examiner stated, "the use of one dispensing means over another would have been an obvious design choice for one of ordinary skill in the art." (page 2, last para.). The Examiner cited a portion of the Appellant's specification as evidence in that the Appellant stated that the dispensing can be performed by means other than ink jetting. However, it is noted that, despite this disclosure, the Applicant has narrowed to ink-jetting to advance prosecution, and other disclosure of other types of dispensing should not be used against the applicant when they are narrowing the claims away from those other types of dispensing.

After receiving three consecutive Final Office Action rejections, Appellant decided it would be beneficial to appeal the present claims so that a neutral third party could decide these issues. Appellant filed a Notice of Appeal on June 22, 2006.

The shortcomings of the rejections will now be reviewed. Arguments and statements by Appellant made earlier but not repeated here are also part of the record for this appeal and are not waived; although they may be modified or supplemented herein. To keep this brief short while still trying to provide an adequate basis for review, some observations and arguments that might have been presented are not included. Accordingly, Appellants' silence herein with respect to particular statements by the United States Patent and Trademark Office does not indicate their agreement with or acquiescence thereto.

B. Appellants' Invention

As evidenced by the art of record, various methods of creating three-dimensional objects are known. What Appellants have invented, and set forth in the claims, is a method for solid free-form fabrication of three-dimensional objects that utilizes very specific compounds in combination to achieve a desired result. The method provides the steps of a) applying a particulate blend in a layer, where the particulate blend can include calcium aluminate particulates and polymeric binder particulates; b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area, wherein the hydrated cement becomes crosslinked; c) hardening the hydrated cement; and d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object. In other words, the specific method as claimed requires the use of a blend of calcium aluminate and polymeric particulates, which blend is hydrated and crosslinked using polyol compound-containing liquid vehicle to form a hydrated crosslinked cement. For example, one can consider a particulate blend of calcium aluminate and polyvinyl alcohol. In the presence of water (and as enhanced by the presence of a polyol),

calcium undergoes a reaction where the aluminate ions disassociate from the calcium. After disassociation, the aluminate ions become crosslinked with the polyvinyl alcohol through a polycondensation reaction to form a hydrated cement compound. During the formation of the cement hydration products, the polymer, and other additives can be trapped in the matrix resulting in a three dimensional microstructure. In addition, metal ions released from the calcium aluminate can crosslink with the polyol to further enhance the mechanical properties of the finished cement product. This feature of the presently claimed invention is provided by a specific combination of compounds as presently claimed, and such results have been found to be unexpectedly better than the prior art.

To Appellants' knowledge, they were the first to make solid three-dimensional free-form objects by following the method outlined in the claims. Specifically, the method includes applying a particulate blend (which includes calcium aluminate particulates and polymeric binder particulates) in a layer; ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area, wherein the hydrated cement becomes crosslinked; hardening the hydrated cement; and additionally repeating the process such that multiple layers of the cement are formed that are bound to one another. This process yields a solid three-dimensional object.

The claims added during prosecution are drawn to methods for solid free-form fabrication of three-dimensional objects, wherein the step of accelerating the hardening of the hydrated cement by using a lithium ion source is required. This lithium ion source can be present in the particulate blend or the liquid vehicle.

C. Asserted References

1. The Bredt Reference

Bredt discloses a method for printing three-dimensional functional parts. See abstract. The method provides utilizing a printing composition comprising a mixture of particles including a filler and an adhesive. See paragraph [0008]. The composition can also include a fibrous component, a printing aid, and an activating fluid comprising an additional adhesive. See paragraphs [0008], [0021], and [0009]. Bredt teaches placing a layer of particulate material on a downwardly movable surface of a container. See paragraph [0032]. An activating fluid may be applied to the particulate material by means of an electromechanical ink-jet nozzle. See paragraph [0009]. Bredt teaches that the filler component of the particulate material may be a calcium aluminate compound (as listed amongst several possible filler compounds) and can be mixed with an adhesive particulate. See paragraphs [0052] and [0049]. The activated fluid applied to the particulate material acts as a binder and can include one or more of many listed compounds. See paragraphs [0009], [0057]-[0073].

2. The Jang Reference

Jang teaches a process for fabricating colorful 3-D objects. See abstract and column 6, lines 64-66. The process includes operating a multiple-channel droplet deposition device for supplying and ejecting droplets of multiple liquid compositions containing a solidfiable baseline body-building materials and different colors. See abstract. The Examiner noted that the Jang was cited as a secondary reference to show the addition of a pigment, dye or other colorant to a three dimensional object. See Office Action of 12/20/2004, page 4, lines 5-8.

3. The Unsin Reference

Unsin teaches a quick-setting, hydraulic binding agent, containing calcium silicate cement, reactive calcium aluminates, and possibly additives. See abstract. Unsin notes that lithium salts are suitable as accelerators for high alumina cement, but that "it was found that compositions which contain high alumina cement, gypsum and lithium salts as accelerators by themselves show an excessive shrinkage and wet expansion when in a hardened state." See column 1, lines 34-39. Unsin further shows the use of lithium carbonate as accelerator for aluminates in a quantity of 0.05% relative to the total composition in an example. See column 3, line 17.

D. Rejections Under 35 U.S.C. § 103(a) over Bredt alone or, alternatively, in view of Jang and Unsin.

The Examiner rejected claims 1-11 and 42-52 as being *prima facie* obvious over Bredt alone or in view of Jang and Unsin under 35 U.S.C. § 103(a). The PTO, through the Examiner, has the burden of establishing *prima facie* obviousness. Appellant contends that the Examiner has not met its burden of establishing a *prima facie* case of obviousness for at least four reasons. First, none of the references, alone or in combination, teach or suggest each claimed limitation of the instant invention. Second, the Bredt reference teaches away from the claimed invention. Third, modifying Bredt reference to arrive at the claimed invention would destroy the function of Bredt. And fourth, Unsin is of non-analogous art, and therefore an improper reference. Therefore, the Examiner has not met the burden of establishing a prima facie case of obviousness.

1. Requirements for Prima Facie Obviousness

The issue under § 103 is whether the PTO has stated a case of prima facie obviousness. "The PTO has the burden under § 103 to establish a prima facie case of obviousness." In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). To satisfy this burden, the PTO must meet the criteria set out in M.P.E.P § 706.02(j):

> [T]hree basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Moreover, the obviousness analysis must comply with the statutory scheme as explained by the Supreme Court in Graham v. John Deere Co., 383 U.S. 1, 17 (1966), namely, consideration must be given to: (1) the scope and content of the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the pertinent art, and (4) additional evidence, which may serve as indicia of non-obviousness.

In In re Dow Chemical Co., 5 U.S.P.Q.2d 1529, (Fed. Cir. 1988), the court states that both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure.

The Federal Circuit stated in In re Carroll, 202 U.S.P.Q. 571, 572 (Fed. Cir. 1979):

> One of the more difficult aspects of resolving questions of non-obviousness is the necessity to guard against slipping into use of hindsight (citing Graham v. Deere). Many inventions may seem obvious to everyone after they have been made. [citation omitted] Thus, in deciding the issue of obviousness, we must look at the prior art presented from a vantage point in time prior to when the invention was made, and through the eyes of a hypothetical person of ordinary skill in the art.

With the above background in mind, Appellants contend that the Patent Office has failed to meet its burden of making a prima facie case of obviousness. Particularly, Appellants submit that the Patent Office has failed to show that each and every element of the claimed invention is contained in the combined references, that there was sufficient motivation to modify the asserted prior art references, and that the references provide a reasonable expectation of success. Thus, any motivation to modify the references to practice the claimed invention is based on impermissible hindsight.

2. Non-obviousness

a) Failure to Teach or Suggest All the Claim Limitations

Even if the asserted references were combined as suggested by the PTO, the resultant combination would still fall short of yielding the claimed invention. According to M.P.E.P § 706.02(j), the asserted prior art reference (or references when combined) must teach or suggest all the claim limitations. See also In re Royka, 490 F.2d 981, 985 180 U.S.P.Q. 580, (CCPA 1974) (reversing an obviousness rejection because the essence of the claimed invention was not present in the asserted references). Bredt, Jang and Unsin do not teach or suggest the step of ink-jetting an aqueous polyol-containing liquid vehicle into an area of a particulate blend and producing a crosslinked hydrated cement as required by claims 1 and 42. Since independent claims 1 and 42 are nonobvious under 35 U.S.C. § 103, claims 2-11 and claims 43-52, which depend from claims 1 and 42, respectively, are also nonobvious. In re Fine, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596 (Fed. Cir. 1988).

All words in a claim may provide limitations and must be considered against the prior art. In In re Wilson, 57 C.C.P.A. 1029, 1033 (CCPA 1971), the board rejected a claim for a "two-

phase composition of incompatible resins" as obvious over other two-phase compositions of resins. The board did not give meaning to the term 'incompatible.' Id. The CCPA held that the term 'incompatible' was sufficiently defined in the specification and that ignoring the term rendered the board's conclusion of obviousness unsupported. Id. at 1033. The court explained that "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art." Id. at 1032.

Similarly, in the instant case, the Examiner failed to recognize and appreciate the differences between the Appellant's invention and the cited references. The Bredt reference teaches a composition that can include a fibrous component, a printing aid, and an activating fluid comprising an additional adhesive. The filler component of the particulate material may be a calcium aluminate compound (as listed amongst several possible filler compounds) and can be mixed with an adhesive particulate. The activated fluid applied to the particulate material acts as a binder and can include one or more of many listed compounds. However, the Bredt reference is devoid of teaching a three dimensional printing method that utilizes several unique ingredients in specific combination that produce crosslinked three-dimensional objects. It is notable that some of the components the Examiner has relied on to make the present rejection are listed as "printing aids." Bredt describes printing aids as materials that are added to the powder material (i.e. filler) before printing in order to provide light adhesion between the powder grains, thereby reducing dust formation. See paragraph [0056].

In contrast, the Appellant's claimed invention provides a method for solid free-form fabrication of three-dimensional objects that utilizes very specific compounds in combination to achieve a desired result. The method provides the steps of a) applying a particulate blend in a

layer, where the particulate blend can include calcium aluminate particulates and polymeric binder particulates; b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area, wherein the hydrated cement becomes crosslinked; c) hardening the hydrated cement; and d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object. In other words, the specific method as claimed requires the use of a blend of calcium aluminate and polymeric particulates, which blend is hydrated and crosslinked using polyol compound-containing liquid vehicle to form a hydrated crosslinked cement. In order to arrive at the claimed invention using Bredt, one would have to specifically pick and choose three key ingredients to work together to arrive at the claimed invention. To make such choices based on Bredt would not have been ascertainable by one skilled in the art, particularly where there is no suggestion to make the specific selections claimed by the Appellant, and where there is not any suggestion that crosslinking is a desired result. Failure to provide such a teaching or suggestion to arrive at the claimed invention renders the presently claimed invention non-obvious. Thus, the Bredt reference is devoid of teaching all of the elements of the Appellant's invention.

Additionally, in the instant case, the Examiner refused to give meaning to the form of the claim in that the Examiner argues that "changes in the sequence of adding ingredients would have been obvious to one of ordinary skill in the art absent evidence to the contrary." The Appellant's invention is a method, not a composition, as indicated by the claim language and the specification. What is claimed compared to Bredt is not merely a change in the sequence of adding the ingredients or components. Bredt teaches a process where a printing aid (such as

polyethylene glycol) is pre-mixed in a filler (such as calcium aluminate) prior to printing. If it is mixed prior to printing, it must follow that the printing aid is not added by a printing process. In contrast, the currently amended method proposed by Appellant requires the aqueous polyol-containing liquid vehicle be ink-jetted onto a particulate blend. As the Examiner is citing polyethylene glycol as the polyol that corresponds to the Appellant's polyol, and as the polyethylene glycol is not added to the filler in Bredt by a printing process, Bredt does not include all of the claim limitations of the presently claimed invention. Bredt clearly does not teach ink-jetting a polyol, which is important to the claimed invention. In order to sustain a rejection under 35 U.S.C. 103(a), then, Bredt must include a suggestion to make such a modification to arrive at the claimed invention, which it does not.

In fact, the form and application of the polyol via ink jet (as opposed to Bredt's pre-mix into the powder filler) has advantages that would not be obvious to one having ordinary skill in the art. Inherently, the use of ink-jet architecture to apply the aqueous polyol-containing liquid vehicle into an area of a particulate blend uses less polyol material as compared to Bredt's usage. Further, by only applying the polyol to only discrete portions of the particulate blend, as in the instant invention, the "anti-dusting" advantage is not achieved throughout the powder bed, as Bredt desires. Bredt teaches polyethylene glycol mixed with a particulate mixture prior to application of an aqueous binder. As the portion of the particulate mixture not used (i.e. attached with the binder) and is later discarded, Bredt's method inherently wastes a portion of the polyol.

Another inherent advantage to the method proposed by the Appellant is that, in addition to the conservation of polyol, there is an expectation of better and more complete mixing based on the properties of a liquid form which the polyol is applied and the method of application. The

Bredt reference mixes the polyethylene glycol into a particulate mixture, which remains a particulate mixture, thus naturally inhibiting mixing by the solid particle nature of the particulate mixture. Conversely, the Appellant's claims inherently pre-mixes the polyol into an aqueous mixture that then is applied to a particulate blend that produces hydrated cement, and thus, provides a more consistent mixing of the polyol in the final product.

Furthermore, following the Examiner's reasoning, if the difference between the Appellant's invention and Bredt was merely a change in the sequence of adding the ingredients (a point not conceded by the Appellant), Bredt would naturally require a greater amount of the polyol ingredient compared to that of the Appellant's invention. The Examiner's argument that it is merely a change in sequence of adding ingredients is thus flawed as the process of making identical structures would require differing amounts of the polyol ingredient. Specifically, the Bredt composition would require an excess of polyol. Accordingly, the Examiner's conclusion of non-obviousness is unsupported by the prior art, even under the Examiner's problematic compositional analysis.

The rejection was based on Bredt alone or in combination with Jang and Unsin. Jang was cited as disclosing the use of a colorant in forming decorative objects. Unsin was cited as disclosing the use of a lithium accelerant. As neither reference remedies the elements missing from Bredt, namely teaching of cross-linking, of ink-jetting of a polyol, or inherently pre-mixing a polyol in a liquid prior to ink-jetting, the Examiner has failed to show all of the claimed elements in any combination of Bredt, Jang and Unsin.

b) Teaching Away

The Examiner's primary reference teaches away from the present invention. "A prima

facie case of obviousness can be rebutted if the applicant . . . can show 'that the art in any material respect taught away' from the claimed invention." In re Geisler, 116 F. 3d 1465, 1469, 43 U.S.P.Q. 2d 1362, 1365 (Fed. Cir. 1997) (quoting In re Malagari, 499 F.2d 1297, 1303, 182 U.S.P.Q. 549, 533 (CCPA 1974). "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, . . . would be led in a direction divergent from the path that was taken by the applicant." Tec Air, Inc. v. Denso Mfg. Mich. Inc., 192 F.3d 1353, 1360, 52 U.S.P.Q.2d 1294, 1298 (Fed. Cir. 1999).

Bredt teaches away from ink-jetting a polyol onto a particulate blend. Bredt teaches that a printing aid can be dispersed throughout the particulate blend. The reference then goes on to identify polyethylene glycol as a possible printing aid. Bredt teaches that printing aids can provide light adhesion between powder grains prior to printing and can then reduce dust formation. As the printing aid is to be used before printing and to reduce dust formation, it would be illogical to use polyethylene glycol during a printing step, as in the Appellant's invention. Therefore, as Bredt requires pre-mixing of the filler and printing aid materials prior to printing, Bredt specifically teaches away from applying a printing aid using the printing step after the powder bed is readied for printing.

c) Destroying the Function

The same facts set forth above in section VII/D/2/b above also provides a basis for a finding that utilizing the polyol, or polyethylene glycol as in Bredt, in the printing step would cause this function to cease. Specifically, the polyethylene glycol could not reduce the dust formation prior to printing if it was only used in the later printing step (do to mere changing of the order as suggested by the Examiner). Thus, to make the modification suggested by the

Examiner, the "printing aid" of Bredt would cease to function as set forth in its own specification because it would not be able to act as an anti-dusting agent (as it is not yet applied). Only if it were used both for anti-dusting (before printing) and for subsequent printing would this function be possible so that it would also read on the presently pending claims. The problem with that interpretation is that there is no suggestion of using polyethylene glycol in multiple steps.

Furthermore, a person of ordinary skill would not attempt to ink-jet the polyol-containing mixture of Bredt as Bredt specifically points out that the "clogging can occur when binders having high levels of solids are used." See paragraph [0006]. As the polyethylene glycol of Bredt is mixed into a particulate mixture, it would be a stretch to believe that anyone of basic to ordinary skill in the art would even consider ink-jetting the particulate mixture.

E. Response to New Arguments for Rejection in April 26, 2006 Office Action

In the Office Action of April 26, 2006, the Examiner put forth additional arguments in favor of rejection that were not discussed in any previous Office Action. As such, Appellant would like to specifically address these arguments. Specifically, the Examiner points out that the Appellant noted that dispensing means other than ink jetting could work with the present invention. The Examiner goes on to reason that because other methods could work, it does not matter whether Bredt teaches the specific act of ink-jetting. The Examiner seems to have missed the natural results of limiting a claim to include ink-jetting. Regardless of the notion that other dispensing means may work with regards to the application of the polyol to the particulate mixture, the Appellant has voluntarily limited the dispensing means to ink-jetting. That said, Bredt still does not teaching or suggesting ink-jetting a polyol, and more specifically, Bredt does not teach or suggest ink-jetting a polyol which is inherently pre-mixed in a liquid.

Additionally, the Examiner argues that the Appellant did not properly account for the secondary references. Specifically, the Examiner seems concerned that, in responding, the Appellant discussed each reference separately. Although most of the discussion throughout prosecution has focused on the primary reference, Bredt, the elements and applicability to the present invention of the secondary references was not lost on the Appellant.

However, the secondary references, Unsin and Jang, were cited as showing very specific elements that did not ultimately affect the overall analysis of Bredt missing certain claimed elements. Unsin was cited as showing the use of a lithium accelerant, and Jang was cited to show the use of a colorant in a three-dimensional object. The use of a colorant in a three-dimensional object most relates to dependant claims of the present invention (see claims 9 and 50). The colorant does not show any of the missing elements as discussed in the sections above and as such, Unsin was briefly discussed on its merits. However, Unsin in combination with Bredt (and even Jang) does not teach all of the elements of the claimed invention.

Likewise, Jang's teaching of use of a lithium accelerant certainly adds a specific element that was lacking from Bredt. However, the additional teaching of a lithium accelerant does not make up for the missing elements of cross-linking, of ink-jetting a polyol, or of inherently pre-mixing a polyol in a liquid prior to ink-jetting. Therefore, while most of the discussion centers around the primary reference, Bredt, the merits and additional elements of Jang and Unsin were considered, discussed, and found not to remedy the missing elements required for a prima facie case of obviousness.

VIII. CONCLUSION

In conclusion, Appellants respectfully submit that the claims on appeal set forth in the Appendix are patentably distinct from the asserted prior art references. Particularly, none of the asserted references, or any combination thereof, motivates, teaches, or suggests with the requisite specificity to one of ordinary skill in the art, within the meaning of 35 U.S.C. §§ 103, to arrive at the presently claimed invention. Appellants contend neither Bredt alone or in view of Jang and Unsin teach or suggest each and every element of the claimed invention. Moreover, Bredt teaches away from the claimed invention, and any modification that would cause one skilled in the art to arrive at the claimed invention would destroy the function of Bredt.

Since the Patent Office has not met its initial burden of establishing that the claims lack novelty or that the claims are *prima facie* obvious, Appellants respectfully submit that all remaining rejections are improper, and should be overturned.

Dated this ___ day of June, 2006.

_____

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IX. CLAIMS APPENDIX

1. (Previously Presented) A method for solid free-form fabrication of a three-dimensional object, comprising:

a) applying a particulate blend in a layer, said particulate blend including calcium aluminate particulates and polymeric binder particulates;

b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area, wherein the hydrated cement becomes crosslinked;

c) hardening the hydrated cement; and

d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object.

2. (Previously Presented) A method as in claim 1, wherein the aqueous polyol-containing liquid vehicle is dispensed onto the area of the particulate blend by ink-jetting.

3. (Original) A method as in claim 1, further comprising the step of removing a portion of the particulate blend that does not form the hydrated cement.

4. (Original) A method as in claim 1, wherein the polymeric binder particulates are selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic acid), soluble starch, methylcellulose, and combinations thereof.

5. (Original) A method as in claim 1, wherein the polyol of the liquid vehicle is selected from the group consisting of glycerol, ethoxylated glycerol, and combinations thereof.

6. (Original) A method as in claim 1, wherein the polyol of the liquid vehicle is polyethylene glycol having a weight average molecular weight from 200 Mw to 2000 Mw.

7. (Original) A method as in claim 1, wherein the step of hardening is accelerated by including a particulate lithium ion source in the particulate blend.

8. (Original) A method as in claim 1, wherein the step of hardening is accelerated by including a solvated lithium ion source in the liquid vehicle.

9. (Original) A method as in claim 1, wherein the liquid vehicle further includes a colorant.

10. (Original) A method as in claim 1, wherein the liquid vehicle further comprises a low molecular weight polymer having a weight average molecular weight from 200 Mw to 2000 Mw.

11. (Original) A method as in claim 1, wherein the calcium aluminate particulates have an average particulate size from 10 microns to 80 microns, and wherein the polymeric binder particulates have an average particulate size from 0.5 microns to 80 microns.

12. (Withdrawn) A system for solid free-form fabrication of three-dimensional objects, comprising:

a particulate blend of calcium aluminate particulates and polymeric binder particulates; and

an ink-jettable aqueous polyol-containing liquid vehicle configured for hydrating the particulate blend to form a cement.

13. (Withdrawn) A system as in claim 12, wherein the aqueous polyol-containing liquid vehicle is ink-jettable.

14. (Withdrawn) A system as in claim 12, further comprising a particulate lithium ion source admixed with the particulate blend.

15. (Withdrawn) A system as in claim 12, wherein the particulate lithium ion source is a member selected from the group consisting of lithium citrate, lithium carbonate, lithium formate, and combinations thereof.

16. (Withdrawn) A system as in claim 12, further comprising a solvated lithium ion source solvated in the liquid vehicle.

17. (Withdrawn) A system as in claim 16, wherein the solvated lithium ion source is selected from the group consisting of lithium hydroxide, lithium carbonate, lithium citrate, and combinations thereof.

18. (Withdrawn) A system as in claim 12, further comprising an ink-jet pen configured for ink-jetting the liquid vehicle onto the particulate blend.

19. (Withdrawn) A system as in claim 18, further comprising a substrate configured for carrying the particulate blend in a defined region, said defined region being configured with respect to the ink-jet pen such that the liquid vehicle, upon being ink-jetted from the ink-jet pen, contacts the particulate blend.

20. (Withdrawn) A system as in claim 12, configured for applying multiple layers of cement such that each layer is bound to at least one adjacent layer.

21. (Withdrawn) A system as in claim 12, wherein the polymeric binder particulates are selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), polymethylmethacrylate-co-methacrylic acid, soluble starch, methylcellulose, and combinations thereof.

22. (Withdrawn) A system as in claim 12, wherein the polymeric binder particulates have

a weight average molecular weight from 2,000 Mw to 1,000,000 Mw.

23. (Withdrawn) A system as in claim 12, wherein the calcium aluminate particulates are present in the particulate blend at from 40 wt% to 95 wt%.

24. (Withdrawn) A system as in claim 12, wherein the calcium aluminate particulates have an average particulate size from 10 microns to 80 microns, and wherein the polymeric binder particulates have an average particulate size from 0.5 microns to 80 microns.

25. (Withdrawn) A system as in claim 12, wherein the polyol of the liquid vehicle is glycerol.

26. (Withdrawn) A system as in claim 12, wherein the polyol of the liquid vehicle is ethoxylated glycerol.

27. (Withdrawn) A system as in claim 12, wherein the polyol of the liquid vehicle is polyethylene glycol having a weight average molecular weight from 200 Mw to 2000 Mw.

28. (Withdrawn) A system as in claim 12, wherein the liquid vehicle further includes a colorant.

29. (Withdrawn) A system as in claim 12, wherein the liquid vehicle further includes a shrinkage minimizing agent.

30. (Withdrawn) A system as in claim 29, wherein the shrinkage minimizing agent is a member selected from the group consisting of 2,5-dimethylpropanediol, pentaerythriol, and combinations thereof.

31. (Withdrawn) A system as in claim 12, wherein the liquid vehicle further comprises a low molecular weight polymer having a weight average molecular weight from 200 Mw to 2000

Mw.

32. (Withdrawn) A system as in claim 12, wherein the liquid vehicle is pH balanced to from 6.5 to 10.0.

33. (Withdrawn) A system as in claim 13, wherein the liquid vehicle includes components configured for improving jettability of the liquid vehicle, said components including water, lower saturated aliphatic alcohols, and surfactants.

34. (Withdrawn) A solid three-dimensional prototype composition, comprising multiple layers of cement deposited in contact with one another, each of said multiple layers of cement comprising a particulate blend including calcium aluminate particulates and polymeric binder particulates, said particulate blend being hydrated and hardened by use of an ink-jettable aqueous polyol-containing liquid vehicle.

35. (Withdrawn) A composition as in claim 34, wherein said aqueoud polyol-containing liquid vehicle is ink-jettable.

36. (Withdrawn) A composition as in claim 34, wherein said multiple layers of cement includes a lithium ion source.

37. (Withdrawn) A composition as in claim 34, wherein the lithium ion source is selected from the group consisting of lithium hydroxide, lithium citrate, lithium carbonate, lithium formate, and combinations thereof.

38. (Withdrawn) A composition as in claim 34, wherein the polymeric binder is a member selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic acid), soluble starch, methylcellulose, and

combinations thereof.

39. (Withdrawn) A composition as in claim 34, wherein the polyol is selected from the group consisting of glycerol, ethoxylated glycerol, from 200 Mw to 1000 Mw polyethylene glycol, and combinations thereof.

40. (Withdrawn) A composition as in claim 34, wherein the composition is void of pores larger than about 10 microns.

41. (Withdrawn) A composition as in claim 34, wherein upon drying, the composition substantially retains its size and form.

42. (Previously Presented) A method for solid free-form fabrication of a three-dimensional object, comprising:

a) applying a particulate blend in a layer, said particulate blend including calcium aluminate particulates and polymeric binder particulates;

b) ink-jetting an aqueous polyol-containing liquid vehicle onto an area of the particulate blend to form hydrated cement in the area;

c) hardening the hydrated cement, wherein the step of hardening is accelerated by including a particulate lithium ion source in the particulate blend or a solvated lithium ion source in the liquid vehicle; and

d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object.

43. (Previously Presented) A method as in claim 42, wherein the aqueous polyol-containing liquid vehicle is dispensed onto the area of the particulate blend by ink-jetting.

44. (Previously Presented) A method as in claim 42, further comprising the step of removing a portion of the particulate blend that does not form the hydrated cement.

45. (Previously Presented) A method as in claim 42, wherein the polymeric binder particulates are selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic acid), soluble starch, methylcellulose, and combinations thereof.

46. (Previously Presented) A method as in claim 42, wherein the polyol of the liquid vehicle is selected from the group consisting of glycerol, ethoxylated glycerol, and combinations thereof.

47. (Previously Presented) A method as in claim 42, wherein the polyol of the liquid vehicle is polyethylene glycol having a weight average molecular weight from 200 Mw to 2000 Mw.

48. (Previously Presented) A method as in claim 42, wherein the step of hardening is accelerated by including the particulate lithium ion source in the particulate blend.

49. (Previously Presented) A method as in claim 42, wherein the step of hardening is accelerated by including the solvated lithium ion source in the liquid vehicle.

50. (Previously Presented) A method as in claim 42, wherein the liquid vehicle further includes a colorant.

51. (Previously Presented) A method as in claim 42, wherein the liquid vehicle further comprises a low molecular weight polymer having a weight average molecular weight from 200 Mw to 2000 Mw.

52. (Previously Presented) A method as in claim 42, wherein the calcium aluminate particulates have an average particulate size from 10 microns to 80 microns, and wherein the

polymeric binder particulates have an average particulate size from 0.5 microns to 80 microns.

X. EVIDENCE APPENDIX

(No matter presented)

XI. RELATED PROCEEDINGS APPENDIX

(No matter presented)